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Developing a Cu-As-Se Thin Film for Use in Solar Energy Conversion

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ABSTRACT

Thin film solar cells have gained popularity in recent years because of their flexibility, low relative cost, and scalability. Cu-As-Se films have the potential to be used as effective solar cell absorber layers due to theoretical estimates of their absorption coefficients and band gaps being similar to materials used in successful solar cells. While some thin films comprised of annealed and sintered Cu-As-Se nanoparticles have been created in the past, none have been designed for solar energy conversion applications. The development of these thin films will allow for further improvements in solar cell design and performance as well as in their use in possible thermoelectric applications. Cu-As-Se thin films were developed through the alteration of preceding Cu-As-Se nanoparticle synthesis procedures in order to produce nanoparticles for use in denser and more uniform thin films. The synthesized nanoparticles were coated onto substrates and underwent heat treatment experiments to determine the best conditions for uniform grain growth. To characterize the nanoparticles and thin films after heat treatment, techniques such as Raman spectroscopy, X-ray diffraction, scanning electron microscopy and transmission electron microscopy were used. The results of the experiments allowed us to create and characterize Cu-As-Se thin films, and the characterization of these thin films will expand this research area and contribute to the growing solar cell research field, as well as help illuminate the applications of Cu-As-Se based materials.

KEYWORDS

Photovoltaics, Solar cells, Thin films, Nanoparticles, Nanocrystals